MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

BEC2044 –ECONOMETRICS I

(All sections / Groups)

12 OCTOBER 2016
9.00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **SIX (6)** pages with **FOUR (4)** questions only excluding cover page.
2. Attempt **ALL** questions. The distribution of the marks for each question is given.
3. Write all your answers in the answer booklet provided.
4. Formulas and statistical tables are attached.

QUESTION 1

A group of researchers consider estimation of airline cost function. The table below contains output obtained using their data to estimate a function of the form

$$\ln(VC) = \beta_1 + \beta_2\ln(Y) + \beta_3\ln(K) + \beta_4\ln(PL) + \beta_5\ln(PF) + \beta_6\ln(PM) + \beta_7\ln(STAGE) + e \quad \ldots (1.1)$$

where VC = variable cost; Y = output; K = capital stock; PL = price of labour; PF = price of fuel; PM = price of materials; and STAGE = average flight length.

Table: Estimation Output of Airline Cost Function

Dependent Variable: ln(VC) **Included observations: 268**	**Coefficient**	**Standard Error**	**Tolerance**
Constant	7.5289	(0.5822)	-
ln(Y)	0.6792	(0.0534)	0.214
ln(K)	0.3503	(0.0529)	0.701
ln(PL)	0.2754	(0.0438)	0.904
ln(PF)	0.3219	(0.0361)	0.252
ln(PM)	-0.0683	(0.1003)	0.578
ln(STAGE)	-0.1944	(0.0286)	0.384

$R^2 = 0.9895$; Jarque-Bera χ^2 statistics = 2.87; Durbin-Watson d = 3.91

(a) Hypothesise the signs for output, capital stock, price of labour, price of fuel, price of materials and average flight length. Do the estimated coefficients have the anticipated signs? (3 marks)

(b) Compute the value of adjusted R^2. (2 marks)

(c) Is the error term normally distributed? Use 5% as the level of significance. (5 marks)

(d) Is the overall regression significant? Use 5% as the level of significance. (5 marks)

(e) Interpret the coefficients of ln(Y), ln(K) and ln(PF). (5 marks)

(f) Is there a positive relationship between the variable cost and output? Use 5% as the level of significance. (5 marks)

(g) Develop and test (use 5% as the level of significance) appropriate hypotheses for the coefficients of capital stock, price of labour, price of fuel, price of materials and average flight length. Which coefficients are not significantly different from zero? Which variable(s) would you consider to omit from the model? (10 marks)

(h) Compute the Variance Inflation Factor for each independent variable. Assess the degree of multicollinearity and determine its effects. (5 marks)

(Total: 40 marks)

Continued...

QUESTION 2

(a) An estimation of public transport cost function based on 268 observations yields the following results:

$$\widehat{VC} = 1861.05 + 1.97Y + 1.42K + 1.32PL + 1.38PF + 0.93PM + 0.82STAGE \quad ...(2.1)$$

Durbin-Watson statistic = 3.91

(i) Determine if there is first-order serial correlation for the above model. (4 marks)

(ii) Describe step-by-step how you would apply the Breusch-Godfrey test for second-order autocorrelation. Your answer should be specific to model (2.1). (6 marks)

(b) "Heteroscedasticity, when left unchecked, can leave a research which has found statistically significant results open to criticism". Explain. (4 marks)

(c) Consider the model below:

$Sales_i = \alpha + \beta Y_i + \gamma M_i + \mu_i$

where
$Sales_i$ = the sale of a firm in the i-th region,
Y_i = total income in the region, and
M_i = the amount of money spent by the company advertising in that region.

You suspect that the random error term μ_i has heteroscedasticity with a standard deviation σ that depend on the amount of money spent M_i. Describe the procedure of White test in testing for the heteroscedasticity. (6 marks)

(Total: 20 marks)

QUESTION 3

(a) A researcher estimates the following two econometric models

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + u_t \quad ...(3.1)$$

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_4 x_{4t} + v_t \quad ...(3.2)$$

where u_t and v_t are iid disturbances and x_{4t} is an irrelevant variable which does not enter into the data generating process for y_t. Will the value of

(i) R^2, (5 marks)

(ii) Adjusted R^2 (5 marks)

be higher for the second model than the first? Explain your answers.

Continued...

(b) Suppose that the "true model" is:

$$\ln Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \varepsilon \qquad \ldots (3.3)$$

but we estimate using the following model:

$$\ln Y = \alpha_0 + \alpha_1 \ln X_1 + \alpha_2 \ln X_2 + \alpha_3 X_3 + \varepsilon \qquad \ldots (3.4)$$

(i) What are the consequences of "incorrect functional form" in estimation? (3 marks)

(ii) How can the problem stated in (i) be detected? (4 marks)

(iii) How can the problem stated in (i) be corrected? (3 marks)

(Total: 20 marks)

QUESTION 4

An econometrics department at a local university keeps track of its major's starting salaries. Does taking econometrics affect starting salary? Let SAL = salary in RM, GPA = grade point average on a 4.0 scale, METRICS = 1 if student took econometrics, and METRICS = 0 otherwise. Using the data of 50 recent graduates, the estimated regression is obtained:

$$\widehat{SAL} = \underset{(1078)}{24200} + \underset{(352)}{1643}GPA + \underset{(456)}{5033}METRICS \qquad R^2 = 0.74$$

(std. error) in parentheses

(a) Interpret the estimated equation. (8 marks)

(b) How would you modify the equation to see if women had lower starting salaries than men? {Hint: Define a dummy variable FEMALE = 1, if female; 0 otherwise.} (6 marks)

(c) How would you modify the equation to see if the value of econometrics was the same for men and women? (6 marks)

(Total: 20 marks)

End of Page

Formulas

$$\text{t - statistic} = \frac{\hat{\beta} - \beta}{se(\hat{\beta})}$$

$$\text{F - statistic} = \frac{ESS/(k)}{RSS/(n-k-1)} = \frac{R^2/(k)}{(1-R^2)/(n-k-1)}$$

$$R^2 = \frac{ESS}{TSS}$$

$$\text{Adjusted } R^2 = 1 - (1 - R^2)(\frac{n-1}{n-k-1})$$

Total Sum of Squares (TSS) = Explained Sum of Squares (ESS) + Residual Sum of Squares (RSS)

White's general heteroscedasticity test statistics, $\chi^2_{df=k} = n \times R^2$

$\rho \approx 1 - (d/2)$

Statistical Tables

Appendix 1: t-Table

two tails	**0.2**	**0.1**	**0.05**	**0.02**	**0.01**
One tail	**0.1**	**0.05**	**0.025**	**0.01**	**0.005**
df					
10	1.37	1.81	2.23	2.76	3.17
20	1.33	1.72	2.09	2.53	2.84
30	1.31	1.70	2.04	2.46	2.75
40	1.30	1.68	2.02	2.42	2.70
50	1.30	1.68	2.01	2.40	2.68
60	1.30	1.67	2.00	2.39	2.66
75	1.29	1.67	1.99	2.38	2.64
100	1.29	1.66	1.98	2.36	2.63
120	1.29	1.66	1.98	2.36	2.62

Appendix 2: F-table (α=0.05)

df2\df1	1	2	3	4	5	6	7	8
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18
50	4.03	3.18	2.79	2.56	2.40	2.29	2.20	2.13
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10
70	3.98	3.13	2.74	2.50	2.35	2.23	2.14	2.07
80	3.96	3.11	2.72	2.49	2.33	2.21	2.13	2.06
100	3.94	3.09	2.7	2.46	2.31	2.19	2.10	2.03
200	3.89	3.04	2.65	2.42	2.26	2.14	2.06	1.98
500	3.86	3.01	2.62	2.39	2.23	2.12	2.03	1.96
1000	3.85	3.00	2.61	2.38	2.22	2.11	2.02	1.95

Appendix 3: Chi-square table (α=0.05)

df	$\alpha = 0.05$
1	3.84
2	5.99
3	7.82
4	9.49
5	11.07
10	18.31
20	31.41
30	43.77
40	55.76
50	67.51
100	124.34

Appendix 4: Durbin Watson d Table

Critical Values for the Durbin-Watson Statistic (d)

Level of Significance $\alpha = 0.05$

n	$k = 1$		$k = 2$		$k = 3$		$k = 4$		$k = 5$	
	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U
10	0.88	1.32	0.70	1.64	0.53	2.02	0.38	2.41	0.24	2.82
15	1.08	1.36	0.95	1.54	0.82	1.75	0.69	1.97	0.56	2.21
20	1.20	1.41	1.10	1.54	1.00	1.68	0.90	1.83	0.79	1.99
25	1.29	1.41	1.21	1.55	1.12	1.66	1.04	1.77	0.95	1.89
30	1.35	1.49	1.28	1.57	1.21	1.65	1.14	1.74	1.07	1.83
40	1.44	1.54	1.39	1.60	1.34	1.66	1.29	1.72	1.23	1.79
50	1.50	1.59	1.46	1.63	1.42	1.67	1.38	1.72	1.34	1.77
60	1.55	1.62	1.51	1.65	1.48	1.69	1.44	1.73	1.41	1.77
70	1.58	1.64	1.55	1.67	1.52	1.70	1.49	1.74	1.46	1.77
80	1.61	1.66	1.59	1.69	1.56	1.72	1.53	1.74	1.51	1.77
90	1.63	1.68	1.61	1.70	1.59	1.73	1.57	1.75	1.54	1.78
100	1.65	1.69	1.63	1.72	1.61	1.74	1.59	1.76	1.57	1.78
150	1.72	1.75	1.71	1.76	1.69	1.77	1.68	1.79	1.66	1.80
200	1.76	1.78	1.75	1.79	1.74	1.80	1.73	1.81	1.72	1.82

n	$k = 6$		$k = 7$		$k = 8$		$k = 9$		$k = 10$	
	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U
10	–	–	–	–	–	–	–	–	–	–
15	0.45	2.47	0.34	2.73	0.25	2.98	0.18	3.22	0.11	3.44
20	0.69	2.16	0.60	2.34	0.50	2.52	0.42	2.70	0.34	2.89
25	0.87	2.01	0.78	2.14	0.70	2.28	0.62	2.42	0.54	2.56
30	1.00	1.93	0.93	2.03	0.85	2.14	0.78	2.25	0.71	2.36
40	1.18	1.85	1.12	1.92	1.06	2.00	1.01	2.07	0.95	2.15
50	1.29	1.82	1.25	1.88	1.20	1.93	1.16	1.99	1.11	2.04
60	1.37	1.81	1.34	1.85	1.30	1.89	1.26	1.94	1.22	1.98
70	1.43	1.80	1.40	1.84	1.37	1.87	1.34	1.91	1.31	1.95
80	1.48	1.80	1.45	1.83	1.43	1.86	1.40	1.89	1.37	1.93
90	1.52	1.80	1.49	1.83	1.47	1.85	1.45	1.88	1.42	1.91
100	1.55	1.80	1.53	1.83	1.50	1.85	1.48	1.87	1.46	1.90
150	1.65	1.82	1.64	1.83	1.62	1.85	1.60	1.86	1.59	1.88
200	1.71	1.83	1.70	1.84	1.69	1.85	1.68	1.86	1.67	1.87

where $\boldsymbol{n}$ = number of observations and $\boldsymbol{k}$ = number of independent variables, excluding the intercept.